81269_2.book Page i Wednesday, August 9, 2006 3:29 PM

ST6002 SmartPilot Controller

Operating Guide

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81269_2.book Page ii Wednesday, August 9, 2006 3:29 PM

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81269_2.book Page i Wednesday, August 9, 2006 3:29 PM

Important Information

About the documentation provided

Welcome to Raymarine SmartPilot. The autopilot system that will steer your boat to a heading automatically, accurately, reliably and comfortably.

SmartPilot documentation is arranged so that you can install, commission and quickly use your SmartPilot, keeping to hand only the information necessary.

- **Installation Sheets** - One per element of the system, these easy to understand sheets guide you through the installation process. These can be discarded once the installation is complete.
- **SmartPilot Commissioning Guide** - Describes how to connect, commission and configure the system. Supplied with systems only.
- **Quick Start Guide** - Once commissioned, use your Smart Pilot right away with this handy guide to the main operations.
- **Operating Guide** - This handbook. Contains a detailed description of the SmartPilot's features and functions.

Warranty

To register your new Raymarine product, please take a few minutes to fill out the warranty card. It is important that you complete the owner information and return the card to us to receive full warranty benefits. You can also register online at **www.raymarine.com**

Safety notices

WARNING: Calibration

We supply this product calibrated to default settings that should provide initial stable performance for most boats. To ensure optimum performance on your boat, you must complete the procedures in *SmartPilot Commissioning Guide* before use.

WARNING: Navigation aid

Although we have designed this product to be accurate and reliable, many factors can affect its performance. As a result, it should only be used as an aid to navigation and should never replace common sense and navigational judgement. Always maintain a permanent watch so you can respond to situations as they develop.

81269_2.book Page ii Wednesday, August 9, 2006 3:29 PM

Your Raymarine SmartPilot will add a new dimension to your boating enjoyment. However, it is the skipper's responsibility to ensure the safety of the boat at all times by following these basic rules:

- Ensure that someone is present at the helm AT ALL TIMES, to take manual control in an emergency.
- Make sure that all members of crew know how to disengage the autopilot.
- Regularly check for other boats and any obstacles to navigation – no matter how clear the sea appears, a dangerous situation can develop rapidly.
- Maintain an accurate record of the boat's position by using either a navigation aid or visual bearings.
- Maintain a continuous plot of your boat's position on a current chart. Ensure that the locked autopilot heading will steer the boat clear of all obstacles. Make proper allowance for tidal set – the autopilot cannot.
- Even when your autopilot is locked onto the desired track using a navigation aid, always maintain a log and make regular positional plots. Navigation signals can produce significant errors under some circumstances and the autopilot will not be able to detect these errors.

Product disposal

Waste Electrical and Electronic (WEEE) Directive
The WEEE Directive requires the recycling of waste electrical and electronic equipment.

Whilst the WEEE Directive does not apply to some of Raymarine's products, we support its policy and ask you to be aware of how to dispose of this product.

The crossed out wheelie bin symbol, illustrated above, and found on our products signifies that this product should not be disposed of in general waste or landfill.

Please contact your local dealer, national distributor or Raymarine Technical Services for information on product disposal.

EMC Conformance

All Raymarine equipment and accessories are designed to the best industry standards for use in the recreational marine environment. Their design and manufacture conforms to the appropriate Electromagnetic Compatibility (EMC) standards, but correct installation is required to ensure that performance is not compromised.

81269_2.book Page iii Wednesday, August 9, 2006 3:29 PM

Handbook information

To the best of our knowledge, the information in this handbook was correct when it went to press. However, Raymarine cannot accept liability for any inaccuracies or omissions it may contain. In addition, our policy of continuous product improvement may change specifications without notice. As a result, Raymarine cannot accept liability for any differences between the product and the handbook.

81269_2.book Page iv Wednesday, August 9, 2006 3:29 PM

81269_2.book Page v Wednesday, August 9, 2006 3:29 PM

Contents

Important Information i
About the documentation provided i
Warranty i
Safety notices i
WARNING: Calibration i
WARNING: Navigation aid i
Product disposal ii
EMC Conformance ii
Handbook information iii
Contents v
Chapter 1: SmartPilot Operation 1
1.1 Introduction 1
SmartPilot Functions 1
Extended systems 2
1.2 Using the control unit 2
Switching on and off 2
Start-up mode 3
Keypad functions 3
What does the display tell me? 4
1.3 Using the SmartPilot to steer your boat 4
CAUTION: Maintain a permanent watch 4
How do I automatically steer to a heading? 4
How do I return to hand steering? 5
How do I change course in Auto mode? 5
Can I dodge an obstacle and then resume course? 6
1.4 How do I adjust the performance of my SmartPilot? 6
Off Course warning 8
1.5 Using the SmartPilot with sail boats 9
Using the SmartPilot to automatically tack (AutoTack) 9
CAUTION: Allow time for course changes 9
How do I prevent accidental gybes? 9
Gusty conditions 10
1.6 Can I adjust the display lighting& contrast? 10
How do I adjust the lights? 10
How do I adjust the contrast? 11
Chapter 2: Advanced Operation 13
2.1 How do I follow a route set on a Chartplotter? 13
How do I activate Track mode? 13
CAUTION: Make suitable preparations for entering track mode 13

81269_2.book Page vi Wednesday, August 9, 2006 3:29 PM

How do I leave Track mode?....14
What is Cross track error?....14
Tidal stream compensation....15
How do I dodge an obstacle in Track mode?....15
What happens when I arrive at a waypoint?....16
How do I skip a waypoint? (SeaTalk chartplotters)....16
WARNING: Ensure navigation safety17
What is the Waypoint Advance warning?....17
What happens when I get to the end of the route?....17
2.2 Using Wind Vane mode – sail boats....18
What is Wind Vane mode?....18
Wind information....18
True and apparent wind....18
WindTrim....18
How do I select Wind Vane mode?....18
How do I leave Wind Vane mode?....19
How do I dodge an obstacle in Wind Vane mode?....19
What is a Wind Shift warning?....20
How do I use AutoTack in Wind Vane mode?....20
Operating hints for Wind Vane mode....21
2.3 How do I display boat data?....21
Can I display Waypoint names?....22
Warning messages....22
Shallow warning (SHALLOW)....22
Man Overboard warning (MOB)....22
2.4 User Calibration Options....22
How do I access User Calibration settings?....23
User Calibration pages....23
AutoTack angle (SAILBOAT only)....23
Gybe inhibit (SAILBOAT only)....23
Wind selection (SAILBOAT only)....24
WindTrim (SAILBOAT only)....24
Response level....24
Chapter 3: Fault Finding & Maintenance....27
3.1 Fault finding....27
SmartPilot alarm messages....28
3.2 General maintenance....30
Routine checks....30
CAUTION: Do not dismantle SmartPilot products....30
Cleaning the display....30
CAUTION: Avoid damage when cleaning....30
EMC advice....31

81269_2.book Page vii Wednesday, August 9, 2006 3:29 PM

Product support 31
World wide web 31
Telephone help line 31
Help us to help you 32
Product details table 33

Specifications 35
ST6002 control unit 35
SmartPilot computer functions 35

Glossary 36

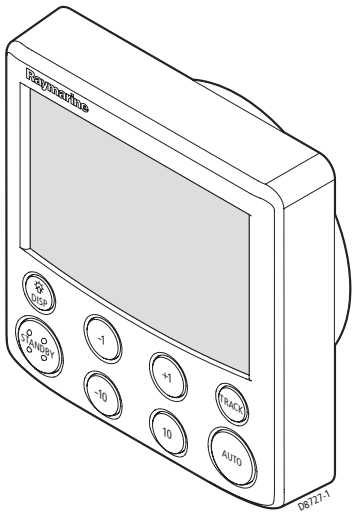
Index 39

81269_2.book Page viii Wednesday, August 9, 2006 3:29 PM

81269_2.book Page 1 Wednesday, August 9, 2006 3:29 PM

Chapter 1: SmartPilot Operation

1.1 Introduction



The SmartPilot controller is a SeaTalk® compatible autopilot control unit. It is designed as the main controller for the SmartPilot system.

The SmartPilot controller operates in the following modes:

- **Standby:** SmartPilot off. You have manual control of the boat.
- **Auto:** The SmartPilot steers the boat to maintain a locked heading.
- **Track:** The SmartPilot steers the boat to maintain a track between two waypoints created on a navigation aid.
- **Wind Vane:** The SmartPilot steers the boat to maintain a course relative to a true or apparent wind angle.

The SmartPilot controller also provides:

- automatic tack (AutoTack) in Auto and Wind Vane modes.
- waypoint advance feature in Track mode.

SmartPilot Functions

The functions provided with your SmartPilot system depend on whether the SmartPilot computer contains an internal GyroPlus yaw sensor.

81269_2.book Page 2 Wednesday, August 9, 2006 3:29 PM

S1G, S2G and S3G systems (with GyroPlus)	Non-G systems (without GyroPlus)
Internal GyroPlus yaw sensor provides enhanced course keeping using AST (Advanced Steering Technology)	Full basic functionality: uses Raymarine steering algorithm without AST
Steering to true and apparent wind in Wind Vane mode	Steering to true and apparent wind in Wind Vane mode
Equipped with AutoLearn, Raymarine's self-learning calibration system	

Extended systems

You can connect the SmartPilot controller to other Raymarine SeaTalk equipment so it can send and receive SeaTalk data:

- it can use waypoint information from a SeaTalk navigation instrument to provide track control.
- it can use boat speed from a SeaTalk speed instrument to optimize track-keeping performance.
- it can use wind information from a SeaTalk wind instrument for Wind Vane steering.

You can also use the SmartPilot with any navigator or wind instrument that transmits National Marine Electronics Association (NMEA) 0183 data.

The SmartPilot control unit can display SeaTalk and NMEA instrument data in a user-defined selection of data pages.

For further information on other connections to your system see *SmartPilot Commissioning Guide.*

1.2 Using the control unit

Switching on and off

All the time that power is applied to the SmartPilot controller, you can use the **disp** button to switch the instrument off and on as follows:

- To switch the SmartPilot controller off, ensure it is in the Standby mode, then hold down the **disp** button for approximately 5 seconds. After this time, a switch off count down of 4 seconds occurs. Keep the **disp** button pressed during this period, to switch off the instrument.
- To switch the instrument back on, hold down the **disp** button for approximately 1 second.

81269_2.book Page 3 Wednesday, August 9, 2006 3:29 PM

When the power supply is switched off, the SmartPilot controller buttons have no effect.

Notes: **(1)** *Each time power to the SmartPilot controller is switched on, the controller is initially in the on condition. You do not need to use the* **disp** *button to switch the controller on.*

(2) *When the SmartPilot controller is on, the operation of the* **disp** *button will perform other operating functions, as described below.*

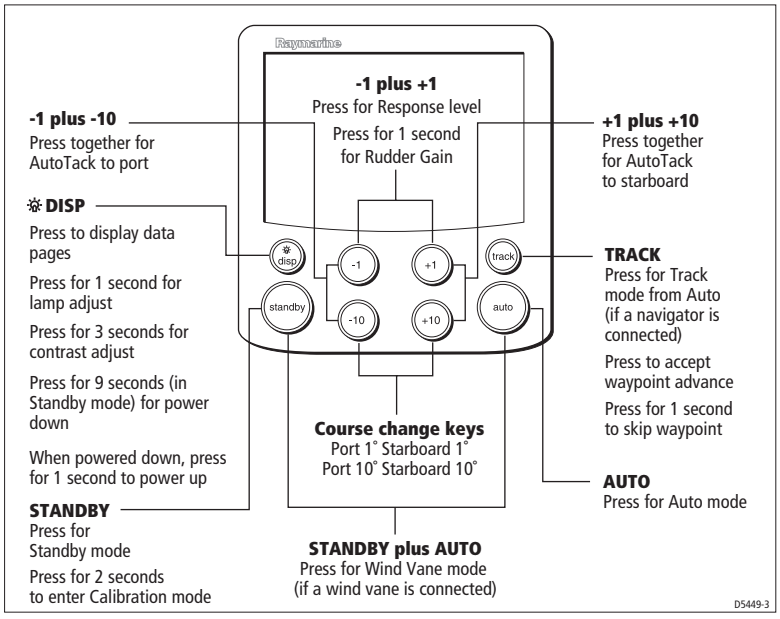
Start-up mode

The SmartPilot always powers up in Standby mode with the display showing the boat's current compass heading.

Note: *You can press* **standby** *at any time to return to manual steering.*

Keypad functions

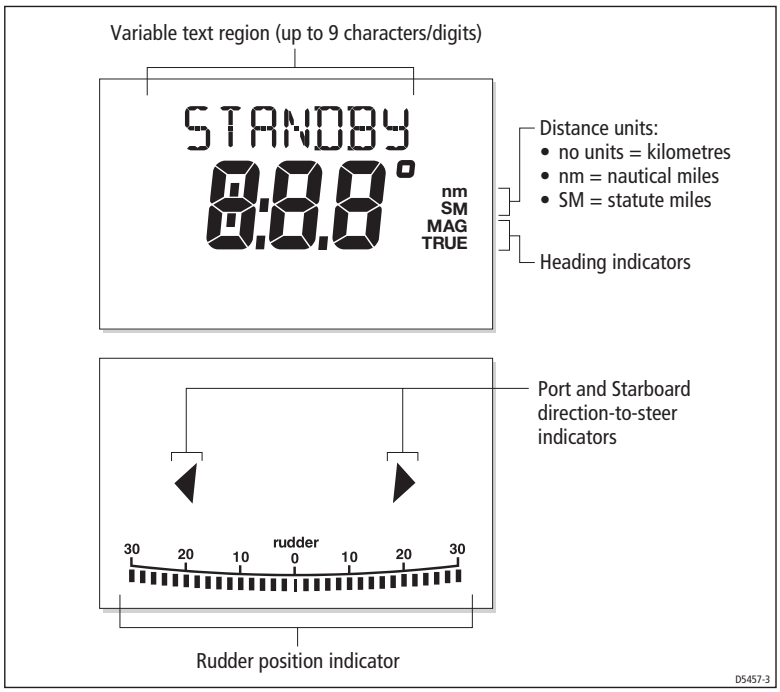
The SmartPilot is controlled using simple push-button operations, all of which are confirmed with a short beep. In addition to the main single-button functions, there are several dual-button operations.



81269_2.book Page 4 Wednesday, August 9, 2006 3:29 PM

What does the display tell me?

The SmartPilot display screen provides the following information:



The bar graph at the bottom of the screen indicates the current position of the rudder, as measured by the rudder position sensor.

1.3 Using the SmartPilot to steer your boat

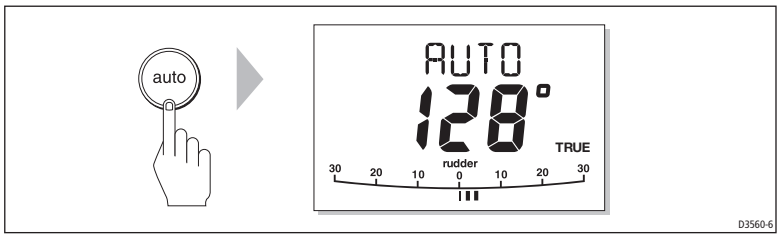
CAUTION: Maintain a permanent watch

Automatic course control makes it easier to sail a boat, but it is NOT a substitute for good seamanship. ALWAYS maintain a permanent watch by the helm.

How do I automatically steer to a heading?

1. Steady the boat on the required heading.
2. Press **auto**.
   The SmartPilot is now in AUTO mode and will steer to the chosen heading, shown on the display. This mode is often known as "point-and-shoot".

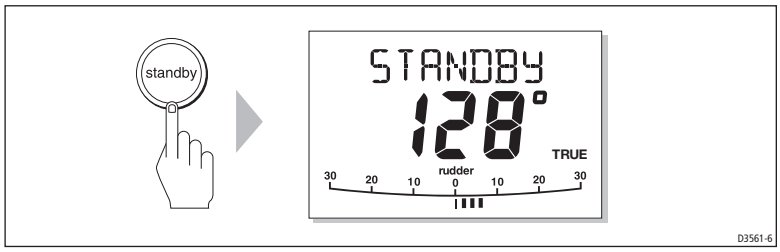
81269_2.book Page 5 Wednesday, August 9, 2006 3:29 PM



How do I return to hand steering?

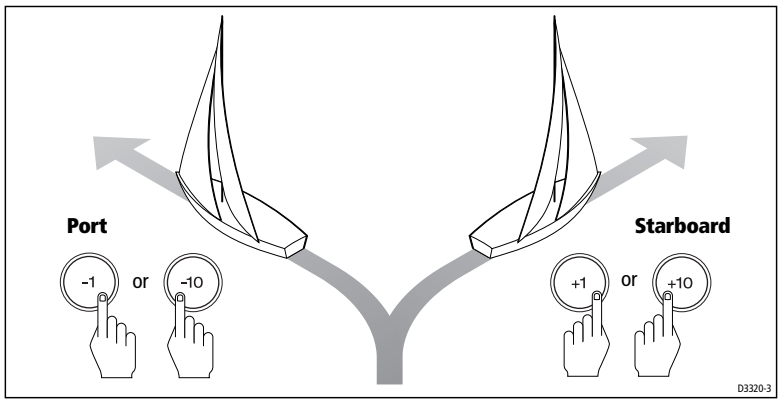
Press **standby** to disengage the SmartPilot:

- in STANDBY mode, you have manual control of the boat and the display shows the boat's current compass heading.



How do I change course in Auto mode?

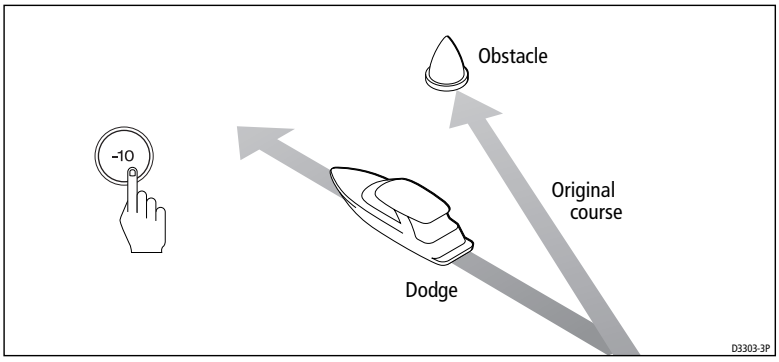
In Auto mode, use the **-1** and **-10** (port) and **+1** and **+10** (starboard) buttons to change the locked heading in steps of 1° or 10°. For example: press **-10** three times for a 30° course change to port.



81269_2.book Page 6 Wednesday, August 9, 2006 3:29 PM

Can I dodge an obstacle and then resume course?

To avoid an obstacle when your boat is under autopilot control, you can dodge the obstacle and then resume your previous course.



1. Select a course change in the appropriate direction. For example, press **-10** three times for a 30°dodge to port.
2. When safely clear of the obstacle, reverse the previous course change (for example, press **+10** three times).

1.4 How do I adjust the performance of my SmartPilot?

The principal method of adjusting the performance of SmartPilot systems is by changing the response level. This is the only user adjustment you should need to make to your SmartPilot on a regular basis.

The response level controls the relationship between the SmartPilot's course keeping accuracy and the amount of helm/drive activity. When you turn on your SmartPilot it will always be at the default level. (This level can be adjusted in User Calibration *see page 24)*

When you require extra tight course keeping (e.g. for pilotage in confined and sheltered waters), increase the setting. If you want to minimize drive activity and conserve battery power, decrease the setting.

You can make temporary adjustments to the response level when using your SmartPilot on a day-to-day basis. By doing this you can match performance to conditions as they occur.

81269_2.book Page 7 Wednesday, August 9, 2006 3:29 PM

Note: *You will lose these temporary changes to response level whenever the system is powered off. You can make permanent adjustments in User Calibration (See page 24). This determines the default power-up response level.*

Adjusting performance – S1G, S2G and S3G systems

S1G, S2G and S3G systems have 9 levels of response:

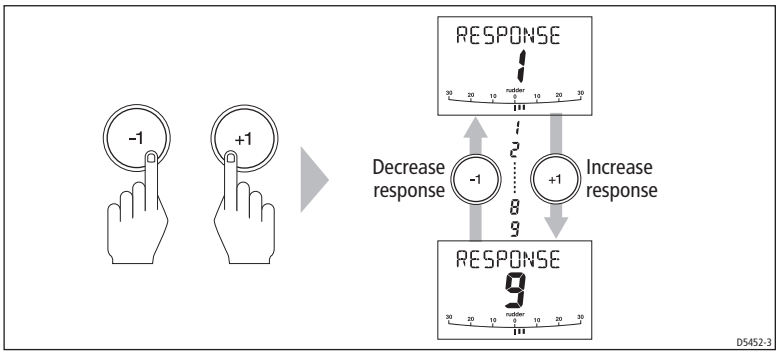
- **level 9 to 7** give the tightest course keeping and greatest rudder activity (and power consumption). This can lead to a rough passage in open waters as the SmartPilot may 'fight' the sea.
- **levels 6 to 4** should give good course keeping with crisp, well controlled turns under normal operating conditions.
- **level 3 to 1** minimizes the amount of pilot activity. This conserves power, but may compromise short-term course-keeping accuracy.

With these points in mind, you should use the following procedure to make temporary adjustments to the response level when required:

1. Display the RESPONSE screen by pressing the **-1** and **+1** buttons together momentarily.

Note: *The* RESPONSE *screen is set as a default data page (see SmartPilot Commissioning Guide) so you can also access it by pressing* **disp** *and then scrolling through the data pages.*

2. Press **-1** or **+1** to change the response level.



3. Press **disp** or wait for 5 seconds to return to the previous display.

Adjusting performance – Non-G systems

Non-G SmartPilot systems have three different response levels:

- **Response Level 1: AutoSeastate on (Automatic deadband)**

  The SmartPilot will gradually ignore repetitive boat movements and only react to true variations in course. This provides the best compromise between power consumption and course keeping accuracy.

81269_2.book Page 8 Wednesday, August 9, 2006 3:29 PM

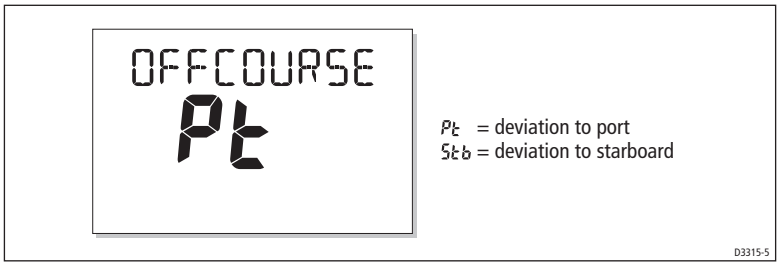
- **Response Level 2: AutoSeastate off (Minimum deadband)**
  This setting provides tighter course keeping but will lead to increased power consumption and drive unit activity.
- **Response Level 3: AutoSeastate off + yaw damping**
  This setting provides the tightest possible course keeping by introducing counter rudder yaw damping You can adjust the counter rudder setting in Dealer Calibration (see *SmartPilot Commissioning Guide*).

To make a **temporary** change to the response setting:

1. Display the RESPONSE screen by pressing the **-1** and **+1** buttons together.
2. Press **-1** or **+1** to change the response between levels 1 to 3.
3. Press **disp** or wait for 5 seconds to return to the previous display.

Note: *You will lose these temporary changes to response level whenever the system is powered off. You can make permanent adjustments in User Calibration (see page 24).*

Off Course warning



The SmartPilot warns you when you have been off course from the locked heading for longer than 20 seconds. It shows whether the deviation is to port or starboard.

Note: *The default off course angle is set at 20°. You can adjust this angle in Dealer Calibration (see SmartPilot Commissioning Guide).*

1. To cancel the off course warning, press **standby** to return to manual steering.
2. Check whether your boat is carrying too much sail, or whether the sails are badly balanced. You can usually significantly improve course keeping by improving the sail balance.

Note: *The SmartPilot also clears the warning if the heading recovers or if you change course.*

81269_2.book Page 9 Wednesday, August 9, 2006 3:29 PM

1.5 Using the SmartPilot with sail boats

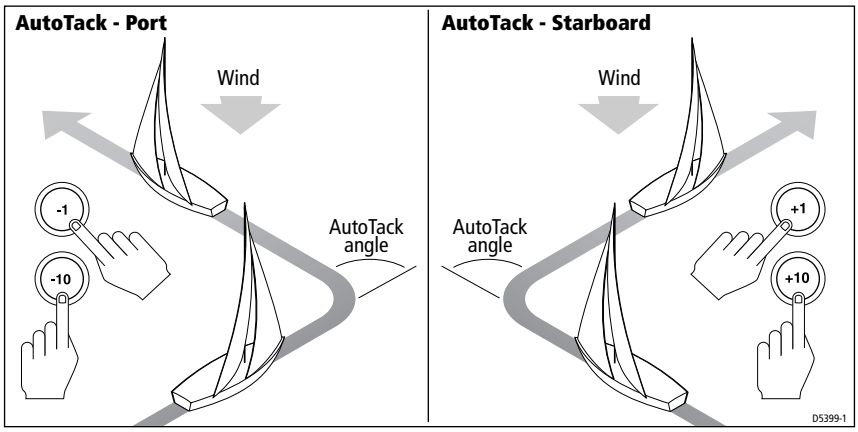
Using the SmartPilot to automatically tack (Auto-Tack)

CAUTION: Allow time for course changes

When making major course changes, the trim on the boat may change substantially. Due to this, the SmartPilot may take some time to settle accurately onto the new course.

The SmartPilot has a built in automatic tack facility (AutoTack) that turns the boat through 100° in the required direction. If you have set the vessel type to SAIL BOAT, you can adjust the default AutoTack angle in User Calibration (see *page 23*).

- to AutoTack to port: press the **-1** and **-10** buttons together
- to AutoTack to starboard: press the **+1** and **+10** buttons together



How do I prevent accidental gybes?

The gybe inhibit feature stops the boat from performing an AutoTack away from the wind – this will prevent accidental gybes. This feature can be disabled if required *(see page 23)*.

Note: *For the gybe inhibit feature to work, the SmartPilot needs suitable wind information.*

With gybe inhibit on:

- you will be able to perform an AutoTack into the wind.
- the autopilot will prevent the boat from performing an AutoTack away from the wind, to prevent accidental gybes.

81269_2.book Page 10 Wednesday, August 9, 2006 3:29 PM

With gybe inhibit off:

- you can perform an AutoTack into or away from the wind.

Note: *Gybe inhibit is switched on as a default but can be disabled in User Calibration (see page 22).*

Gusty conditions

In gusty conditions, the course may tend to wander slightly, particularly if the sails are badly balanced. If you take the following precautions, the SmartPilot will be able to maintain competent control even in gale force conditions:

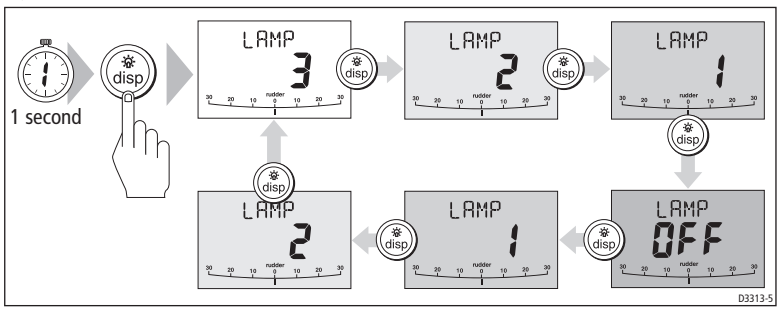
- You can improve course keeping by improving the sail balance:
  - do not allow the boat to heel over excessively.
  - ease the mainsheet traveller to leeward to reduce heeling and weather helm.
  - if necessary, reef the mainsail a little early.
- In very strong winds and large seas, you should avoid sailing with the wind dead astern:
  - ideally, bring the wind at least 30° away from a dead run.
  - in severe conditions, you may also need to remove the mainsail and sail under headsail only.

1.6 Can I adjust the display lighting& contrast?

How do I adjust the lights?

You can adjust the display and keypad lighting by:

1. Pressing **disp** for 1 second from any mode to access the LAMP screen and turn on the lights.



81269_2.book Page 11 Wednesday, August 9, 2006 3:29 PM

2. Press the **disp** button to cycle through the possible illumination settings: LAMP 3 (the brightest setting), LAMP 2, LAMP 1, OFF, LAMP 1, LAMP 2, LAMP 3 and so on:
   - as you change the setting, the illumination on any other SeaTalk instruments or control units will also change.
3. The display automatically returns to the previous mode if you do not press a button for 10 seconds:
   - if you press another mode button within 10 seconds you will select the mode assigned to that button (for example: **auto** selects Auto mode, **standby** selects Standby mode).

Notes: **(1)** *You can also adjust the lighting level from any other SeaTalk instrument or control unit.*

(2) *When you switch off the unit you lose any changes you have made to the lighting level.*

How do I adjust the contrast?

To set the display contrast level:

1. With the autopilot in Standby mode, press the **disp** button for one second to access the LAMP screen.
2. Press the **disp** button for one second again, to display the CONTRAST screen.
3. Use the **up** and **down** arrow buttons to set the required contrast level (from 1 to 15).
4. The display automatically returns to the previous mode if you do not press a button for 10 seconds:

Note: *if you press another mode button within 10 seconds you will select the mode assigned to that button (for example:* **auto** *selects Auto mode,* **standby** *selects Standby mode).*

81269_2.book Page 12 Wednesday, August 9, 2006 3:29 PM

81269_2.book Page 13 Wednesday, August 9, 2006 3:29 PM

Chapter 2: Advanced Operation

2.1 How do I follow a route set on a Chartplotter?

CAUTION: Safety in Track mode
Track mode provides accurate track keeping even in complex navigational situations. However, it is still the skipper's responsibility to ensure the safety of their boat at all times through careful navigation and frequent position checks. Track mode assists precise navigation and removes the tasks of compensating for wind and tidal drift. However, you MUST still maintain an accurate log with regular plots.

In Track mode, the SmartPilot maintains a route between waypoints created on a navigation system. It makes any course changes necessary to keep your boat on course, automatically compensating for tidal streams and leeway.

Track mode is available only if you have connected the SmartPilot to a suitable navigation system providing SeaTalk or NMEA information. *(See SmartPilot Commissioning Guide for connection details)*

Your SmartPilot system can receive route information from:

- a SeaTalk navigation instrument or chartplotter.
- a navigation system transmitting data in NMEA 0183 format.

How do I activate Track mode?

CAUTION: Make suitable preparations for entering track mode

When you enter Track mode, the SmartPilot will bring the boat onto the track in a controlled way. The closer the boat is to the correct heading and track, the quicker it will settle the boat onto the new course. To avoid an unexpected turn, align the boat approximately with the required track before entering Track mode.

Starting with the SmartPilot in AUTO mode and your chartplotter following a route.

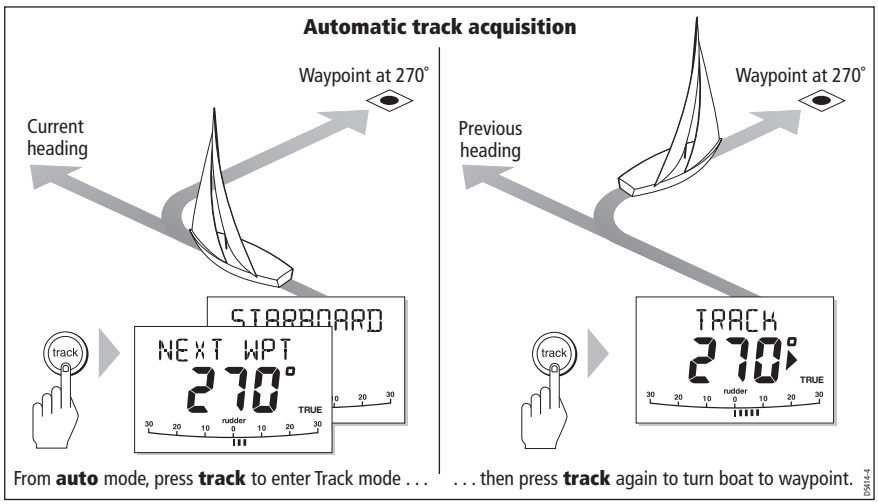
1. Press **track** to enter Track mode.
2. Wait for the warning to sound.
   The display will show the bearing to the next planned waypoint and the direction in which the boat will turn to reach this waypoint.

81269_2.book Page 14 Wednesday, August 9, 2006 3:29 PM

3. If it is safe for the boat to turn onto the new course, press the **track** button:
   - the SmartPilot will turn the boat onto the new course.
   - the display will show the heading required to achieve the required track.

Notes: **(1)** *The rate of turn when in Track mode is set using the* TURN RATE *calibration setting. Adjust this as appropriate for optimum comfort.*

(2) *If the boat is more than 0.3 nm from the track, the Large Cross Track Error warning will sound (see page 14).*



How do I leave Track mode?

You can leave Track mode at any time by:

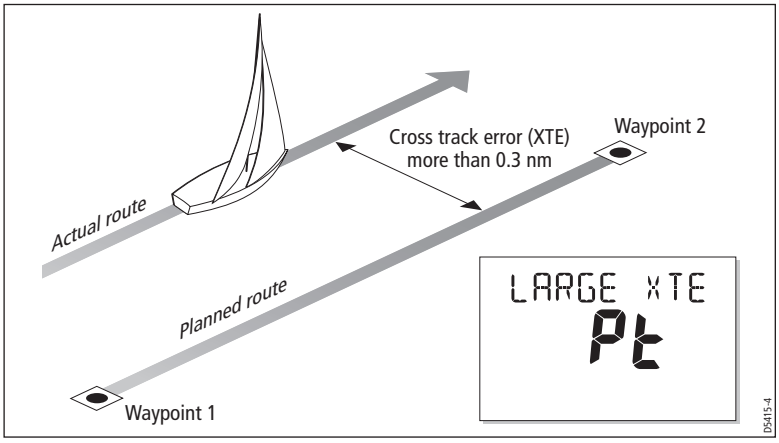
- pressing **auto** to return to Auto mode.
- pressing **standby** to steer manually in Standby mode.

What is Cross track error?

Cross track error (XTE) is the distance between the current position and a planned route. The SmartPilot receives the cross track error information from the navigation equipment, and displays the XTE in nautical miles (nm), statute miles (SM) or kilometres (km).

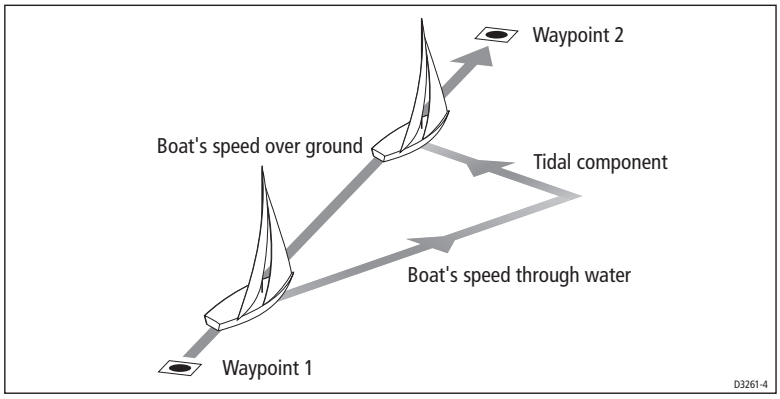
If the cross track error is greater than 0.3 nm, the SmartPilot will sound the Large Cross Track Error warning and show whether you are to the port (Pt) or starboard (Stb) of the planned track.

81269_2.book Page 15 Wednesday, August 9, 2006 3:29 PM



Tidal stream compensation

Under most conditions, the SmartPilot will hold the selected track to within ±0.05 nm (300 ft) or better. It takes account of the boat's speed when computing course changes to ensure optimum performance.



How do I dodge an obstacle in Track mode?

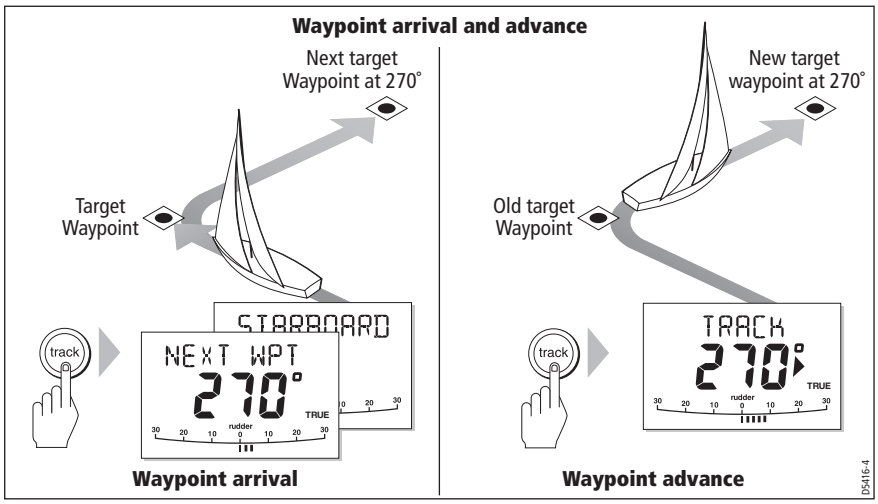
In Track mode you still have full control from the keypad. You can make a dodge maneuver by using the course change buttons (**-1**, **+1**, **-10** or **+10**) to select the desired course change.

On making a dodge maneuver, the autopilot will revert to AUTO mode. Once you are safely past the obstacle, reinitiate Track mode to continue on your planned route.

81269_2.book Page 16 Wednesday, August 9, 2006 3:29 PM

What happens when I arrive at a waypoint?

As the boat arrives at the target waypoint the chartplotter will select the next target waypoint and transmit this to the SmartPilot. It will then detect the new target waypoint name, sound a Waypoint Advance warning and display the Waypoint Advance (NEXT WPT) screen. This shows the new bearing to the next waypoint and the direction the boat will turn to acquire the new track.



How do I get to the next waypoint in a route?

When the Waypoint Advance warning sounds, the SmartPilot suspends Track mode and maintains the current boat heading.To advance to the next waypoint:

1. Check that it is safe to turn onto the new track.
2. Press the **track** button. This will cancel the Waypoint Advance warning and turn the boat towards the next waypoint.

Note: *If you do not press* **track** *to accept the Waypoint Advance, the SmartPilot will maintain the current heading and continue sounding the warning.*

How do I skip a waypoint? (SeaTalk chartplotters)

If you want to advance to the next waypoint **before** you have arrived at the target waypoint, you can skip a waypoint by pressing **track** for 1 second. The display will then show the Waypoint Advance screen for the next waypoint. Check it is safe to turn, then press **track** to turn the boat towards the next waypoint.

81269_2.book Page 17 Wednesday, August 9, 2006 3:29 PM

WARNING: Ensure navigation safety

Skipping a waypoint will take you straight to the next waypoint. Check your navigation before making the turn.

What is the Waypoint Advance warning?

The SmartPilot activates the Waypoint Advance warning (NEXT WPT?) in Track mode whenever the target waypoint name changes. This occurs when:

- you select automatic acquisition by pressing **track** from Auto
- you request waypoint advance by pressing **track** for 1 second in Track mode (with SeaTalk navigators only)
- the boat arrives at the target and the navigator accepts the next waypoint
- you activate the Man Overboard (MOB) function (see *page 22*)

When the warning sounds, the SmartPilot continues on its current heading but displays:

- the bearing to the next waypoint
- the direction the boat will turn to take up that bearing

How do I respond to a Waypoint Advance warning?

To respond to a Waypoint Advance warning:

- check that it is safe to turn onto the new **track**, then press track to accept the waypoint advance
- alternatively, you can cancel the warning without accepting the waypoint advance by pressing:
  - **auto** to continue on the same heading, or
  - **standby** to return to manual control

What happens when I get to the end of the route?

The SmartPilot displays the ROUTE COMPLETED warning when you have reached the last waypoint on a route in Track mode.

- press **auto** to continue on the same heading.
- or press **standby** to return to manual control.

81269_2.book Page 18 Wednesday, August 9, 2006 3:29 PM

2.2 Using Wind Vane mode – sail boats

Note: *You can only select Wind Vane mode if the SmartPilot is receiving suitable SeaTalk or NMEA wind direction information.*

What is Wind Vane mode?

When the SmartPilot is in Wind Vane mode it uses the fluxgate compass as the primary heading reference. As changes in the true or apparent wind angle occur, it adjusts the locked heading to maintain the original wind angle.

Wind information

To use Wind Vane mode, the SmartPilot must receive wind information from one of the following sources:

- SeaTalk wind instrument connected to the autopilot via SeaTalk
- NMEA wind instrument
- Raymarine pushpit wind vane connected via a SeaTalk interface

True and apparent wind

SmartPilots can maintain a course relative to either an apparent or true wind angle in Wind Vane mode

The default setting is apparent wind. If required, you can change this to true wind in User Calibration (see *page 24*).

WindTrim

In Wind Vane mode the SmartPilot uses WindTrim to eliminate the effects of turbulence and short term wind variations. This provides smooth and precise performance with minimal power consumption. You can adjust the wind response (WindTrim) level in User Calibration (see *page 24*) to control how quickly the SmartPilot responds to changes in the wind direction. Higher wind trim settings will result in a pilot that is more responsive to wind changes.

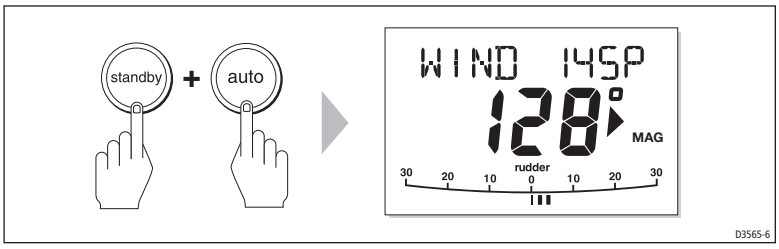
How do I select Wind Vane mode?

You can select Wind Vane mode from either Standby or Auto mode:

1. Steady the boat onto the required wind angle.
2. Press **standby** and **auto** together to select Wind Vane mode and lock the current wind angle:
   - the display shows the locked heading (e.g. 128°) and the wind angle (e.g. WIND 145P indicates an wind angle of 145° to port)

81269_2.book Page 19 Wednesday, August 9, 2006 3:29 PM

- if the SmartPilot does not enter Wind Vane mode, it is not receiving wind data - check the instrument and connections



3. In Wind Vane mode, the SmartPilot will then adjust the boat's heading to maintain the locked wind angle.

How do I leave Wind Vane mode?

You can leave Wind Vane mode by:

- pressing **auto** to return to Auto mode.
- pressing **standby** to return to manual control.

How do I adjust the locked wind angle

You can adjust the locked wind angle by using the **-1**, **+1**, **-10** and **+10** buttons to change course. For example, to bear away by 10° when the boat is on a starboard tack:

- press **-10** to turn the boat 10° to port – the locked wind angle and locked heading will both change by 10°.
- the autopilot will then adjust the locked heading as required to maintain the new wind angle.

Note: *Because turning the boat affects the relationship between the true and apparent wind angles, you should only use this method to make minor adjustments to the wind angle. For major changes, return to Standby mode, steer onto the new heading, then reselect Wind Vane mode.*

How do I dodge an obstacle in Wind Vane mode?

In Wind Vane mode you still have full control from the keypad. You can make a dodge maneuver by using the course change buttons (**-1**, **+1**, **-10** or **+10**) to select the desired course change.

After you have avoided the hazard, you can cancel the dodge course change by making an equal course change in the opposite direction.

81269_2.book Page 20 Wednesday, August 9, 2006 3:29 PM

What is a Wind Shift warning?

If the autopilot detects a wind shift of more than 15° it will sound the wind shift warning and display the WIND SHIFT message:

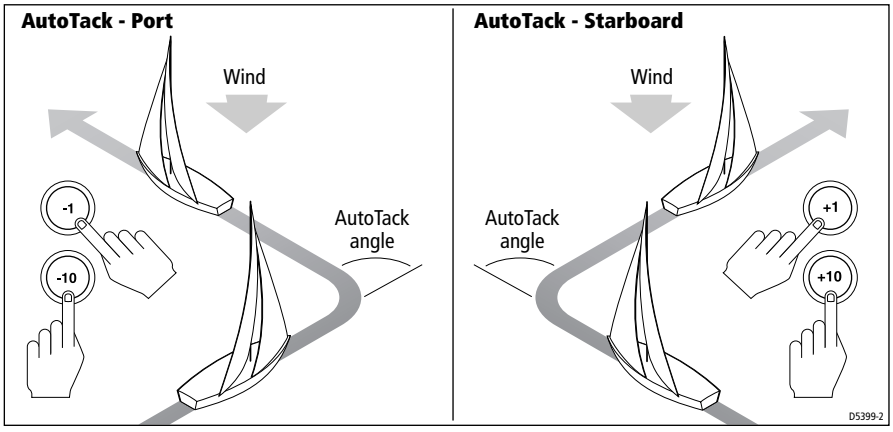
- To cancel the warning, and retain the existing wind angle and new heading, press **standby** and **auto** together.
- Alternatively, to cancel the warning and return to the previous heading:
  - adjust the locked wind angle using the **-1**, **+1**, **-10** and **+10** buttons.
  - press **standby** to return to hand steering, steer onto the required heading, and press **standby** and **auto** together to return to Wind Vane mode with the new wind angle.

How do I use AutoTack in Wind Vane mode?

Note: *If you use the AutoTack function in Wind Vane mode, make sure the wind vane has been centered accurately.*

The SmartPilot has a built in automatic tack facility (AutoTack) that turns the boat through 100° in the required direction:

- to AutoTack to port: press the **-1** and **-10** buttons together.
- to AutoTack to starboard: press the **+1** and **+10** buttons together.



Note: *If you have set the vessel type to* SAIL BOAT*, you can adjust the default AutoTack angle in User Calibration (see page 23).*

When you AutoTack in Wind Vane mode, the boat turns through the AutoTack angle. The SmartPilot will then trim the heading to mirror the locked wind angle from the previous tack.

81269_2.book Page 21 Wednesday, August 9, 2006 3:29 PM

Operating hints for Wind Vane mode

- Always trim your sails carefully to minimize the amount of standing helm.
- Reef the headsail and mainsail a little early rather than too late.
- In Wind Vane mode the SmartPilot will react to long-term wind shifts, but will not correct for short-term changes such as gusts.
- In gusty and unsteady inshore conditions, it is best to sail a few degrees further off the wind so that changes in wind direction can be tolerated.

2.3 How do I display boat data?

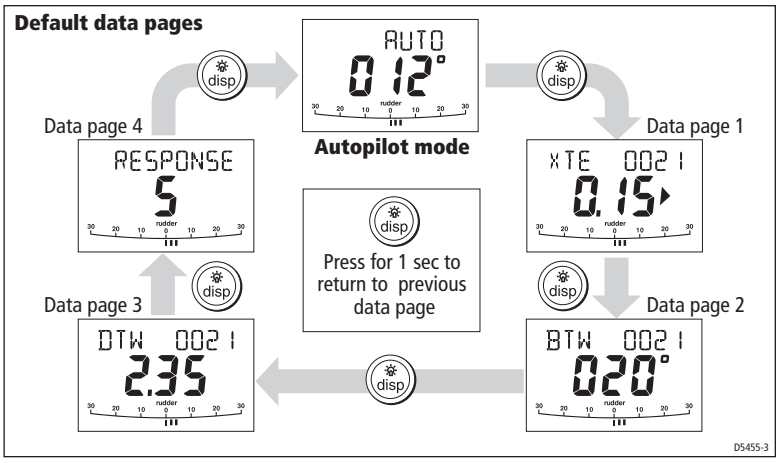
Use the **disp** button to show 'data pages' of SeaTalk or NMEA data:

1. Press **disp** to access the first data page, and press it again to cycle through each data page in turn:
   - when you cycle past the last data page, the display returns to the current SmartPilot mode screen (for example, AUTO).
   - 4 data pages are set in the factory as a default (see diagram): within User setup you can select up to 15 pages and control the information they display (see *SmartPilot Commissioning Guide*).

Notes: **(1)** *If the SmartPilot system cannot obtain the required information, the data page will show dashes instead of a value.*

(2) *The direction-to-steer arrows relate to the data page information.*

(3) *Most data pages show repeated data so you cannot adjust them: the exceptions are the* RESPONSE *and* RUDDER GAIN *data pages, which you can adjust using the* **-1** *and* **+1** *buttons*

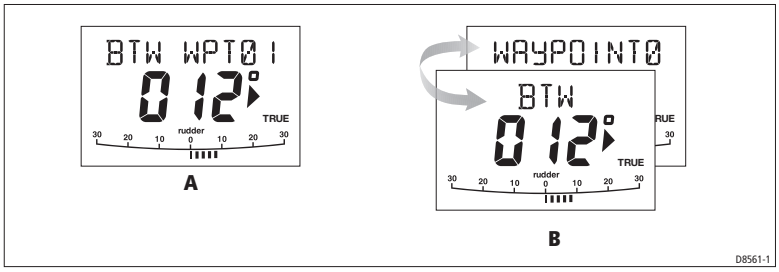


81269_2.book Page 22 Wednesday, August 9, 2006 3:29 PM

Can I display Waypoint names?

If waypoints have been given names, the SmartPilot controller will display them on the Cross Track Error (XTE), Bearing To Waypoint (BTW) and Distance To Waypoint (DTW) data pages:

- waypoint names of five characters or less are displayed together with the page name (as shown by screen **A** below).
- waypoint names of more than five characters alternate with the page name (as shown by screen **B** below).
- if the waypoint name has more than nine characters, the display only shows the first nine characters.



Warning messages

Shallow warning (SHALLOW)

The SmartPilot shows the Shallow warning if it receives a shallow depth message from an instrument on the SeaTalk system. Press **standby** or **disp** to cancel the warning.

Man Overboard warning (MOB)

The SmartPilot activates the Man Overboard warning if it receives a man overboard (MOB) message from another instrument on the SeaTalk system. It displays the text MOB instead of the waypoint number for the XTE, DTW and BTW data pages.

2.4 User Calibration Options

The calibration information in this handbook relates to only those settings that can be adjusted during normal operation (USER CAL). For information on all available calibration settings, see *SmartPilot Commissioning Guide.*

Note: *Many of the settings are sailboat specific and will only be displayed if your vessel type is set to* SAILBOAT.

81269_2.book Page 23 Wednesday, August 9, 2006 3:29 PM

How do I access User Calibration settings?

You can only access the calibration mode from Standby mode:

1. With the SmartPilot in Standby mode, press and hold the **standby** button for 2 seconds. The display will change to show DISPLAY CAL.
2. Press the **disp** button once, the display will now show USER CAL.
3. Press **auto** to enter User Calibration.
   The first page of User Calibration will now be displayed.
4. To access other User Calibration pages, press **disp** to scroll down through the items within that grouping:
5. When you reach an item you wish to adjust, use the **-1, +1, -10** and **+10** buttons (as appropriate) to change the value.
6. When you have made all the changes you want to make, press and hold **standby** for two seconds to exit calibration mode and save changes.

User Calibration pages

AutoTack angle (SAILBOAT only)

The AutoTack angle is the angle through which the boat will turn when you select an automatic tack.

Screen Text	Options
AUTO TACK	40° to 125° in 1° steps

Gybe inhibit (SAILBOAT only)

With gybe inhibit on:

- you will be able to perform an AutoTack into the wind
- to prevent accidental gybes, the SmartPilot will prevent the boat from performing an AutoTack away from the wind

With gybe inhibit off, you can perform an AutoTack into or away from the wind.

Screen Text	Options
GYBE STOP	ON (Default) = Gybe inhibit on (gybes prevented) OFF = Gybe inhibit off (gybes permitted)

81269_2.book Page 24 Wednesday, August 9, 2006 3:29 PM

Wind selection (SAILBOAT only)

This screen determines whether the boat steers to apparent or true wind in Wind Vane mode.

Options	
WIND APP (Default)	SmartPilot steers to apparent wind angle
WIND TRUE	SmartPilot steers to true wind angle

WindTrim (SAILBOAT only)

WindTrim controls how quickly the SmartPilot responds to changes in the wind direction. Higher wind trim settings will result in a system that is more responsive to wind changes.

Screen Text	Options
WIND TRIM	Range = 1 to 9 **1 to 3** - Least responsive to wind changes (less system activity) **4 to 6** - Moderate response to wind changes **7 to 9** - Most responsive to wind changes (more system activity)

Response level

This sets the default SmartPilot response level setting. The response level controls the relationship between course keeping accuracy and the amount of helm/drive activity. You can make temporary changes to response during normal operation, as described in *Chapter 1, SmartPilot Operation*.

S1G, S2G and S3G systems

Screen Text	Options
RESPONSE	Range = 1 to 9 **levels 9 to 7** gives the tightest course keeping and greatest rudder activity (and power consumption). This can lead to a rough passage in open waters as the SmartPilot may 'fight' the sea. **levels 6 to 4** should give good course keeping with crisp, well controlled turns under normal operating conditions. **levels 3 to 1** minimizes the amount of pilot activity. This conserves power, but may compromise short-term course-keeping accuracy.

81269_2.book Page 25 Wednesday, August 9, 2006 3:29 PM

Non-G SmartPilot systems

Screen Text	Options
RESPONSE 1	AutoSeastate on (Automatic deadband). The SmartPilot will gradually ignore repetitive boat movements and only react to true variations in course. This provides the best compromise between power consumption and course keeping accuracy.
RESPONSE 2	AutoSeastate off (minimum deadband). This setting provides tighter course keeping but will lead to increased power consumption and drive unit activity.
RESPONSE 3	AutoSeastate off + counter rudder yaw damping. This setting provides the tightest possible course keeping by introducing counter rudder yaw damping.

81269_2.book Page 26 Wednesday, August 9, 2006 3:29 PM

81269_2.book Page 27 Wednesday, August 9, 2006 3:29 PM

Chapter 3: Fault Finding & Maintenance

All Raymarine products are designed to provide many years of trouble-free operation. We also put them through comprehensive testing and quality assurance procedures before shipping.

This chapter provides information about identifying problems, interpreting alarm messages, maintaining your SmartPilot and obtaining product support.

If a fault occurs with your SmartPilot, use the fault finding tables in this section to help identify the problem and provide a solution. If you cannot resolve the problem yourself, refer to the product support information.

3.1 Fault finding

SYMPTOM	POSSIBLE CAUSE and SOLUTION
Display is blank	No power – check the power and SeaTalk fuses on course computer, then check main fuse/circuit breaker.
Data page display shows stationary dashes	The control unit is not receiving necessary data from other instruments – check cabling.
Display shows rotating dashes	Compass calibration in progress (see SmartPilot Commissioning Guide).
Displayed compass heading does not agree with the boat's compass	You have not calibrated the compass. Carry out the deviation and alignment procedures (see SmartPilot Commissioning Guide).
No display bar on the display	Rudder bar switched off in Display Calibration – select RUDD BAR or STEER BAR.
Rudder bar display moves in opposite direction to rudder	Reverse the red and green rudder position sensor connections at the course computer.
Boat turns slowly and takes a long time to come onto course	Rudder gain too low. Complete AutoLearn or increase gain setting.
Boat overshoots when turning onto a new course	Rudder gain too high. Complete AutoLearn or decrease gain setting.
The SmartPilot 'hunts' when trying to position the rudder	Adjust the RUDD DAMP setting (see SmartPilot Commissioning Guide). Increase the damping one level at a time until the autopilot stops hunting, and always use the lowest acceptable value.

81269_2.book Page 28 Wednesday, August 9, 2006 3:29 PM

SYMPTOM	POSSIBLE CAUSE and SOLUTION
The SmartPilot appears to be unstable on Northerly headings in the Northern hemisphere (or Southerly headings in the Southern hemisphere)	Northerly/Southerly heading correction (AutoAdapt) is not set up (see SmartPilot Commissioning Guide). [Does not apply to S1G, S2G and S3G systems.]
You cannot enter Seatrial Calibration	Seatrial calibration lock is on – turn off the calibration protection feature in Dealer Calibration (see *SmartPilot Commissioning Guide*).
The SmartPilot will not 'talk' to other SeaTalk instruments	Cabling problem – make sure all the cables are connected properly.
Position information not received	Navigator not transmitting the correct position data.
The SmartPilot will not auto advance to the next waypoint	No bearing to waypoint information received from the navigator.
Non-Raymarine 24 V autopilots clutch slipping	Check that the clutch fuse is in the correct position. E.g. 24 V position for 24 V clutches.
When holding a constant course in STANDBY mode, the heading continuously changes	The Autopilot is connected to a Raymarine Pathfinder unit with the "Bridge NMEA Heading" option switched on. Disable this feature on the Pathfinder unit.

SmartPilot alarm messages

When the SmartPilot detects a fault or failure on the system, it will activate one of the alarm messages listed in the following table.

- Unless otherwise stated, you should respond to the alarm by pressing **standby** to clear the alarm and return to manual control, before you attempt to resolve the problem.
- In some situations, the SmartPilot will raise more than one alarm. When you have dealt with the first alarm, it will display the next alarm.

81269_2.book Page 29 Wednesday, August 9, 2006 3:29 PM

ALARM MESSAGE	POSSIBLE CAUSE and SOLUTION
AUTO RELEASE	Possible fault with rudder position sensor – check connections. OR Stern (I/O) drives only – you have taken manual control of steering with AutoRelease on. The alarm cancels automatically after 10 seconds.
CURRENT LIMIT	Serious drive failure – the drive is taking too much current due to short-circuit or jamming. Check the drive unit.
DRIVE STOPPED	The autopilot is unable to turn the rudder (this occurs if the weather load on helm is too high, or if the rudder position sensor has passed beyond the preset rudder limits or rudder end-stops). Check drive and rudder position sensor.
LOW BATTERY	Supply voltage has dropped below acceptable limits. To respond to a Low Battery alarm: • press standby to clear the alarm and return to hand steering • start the engine to recharge the battery
LRN FAIL 1, 2 or 4	AutoLearn not completed successfully. Failure codes: 1 = AutoLearn has not been carried out (default setting) 2 = AutoLearn failed, usually due to manual interruption 4 = AutoLearn failed, probably due to drive or compass failure Repeat the AutoLearn procedure.
MOT POW SWAPPED	Motor cables are connected to power terminals (and power cables are connected to motor terminals) at course computer. Turn off power and swap over connections.

NO DATA	Caused by any of the following situations:
	• the compass is not connected
	• the autopilot is in Wind Vane mode and it has not received wind angle data for 30 seconds
	• the autopilot is in Track mode and:
	  • the autopilot is not receiving SeaTalk navigation data, or
	  • the position sensor (GPS, Loran, Decca) is receiving a low strength signal – this will clear when the signal improves
	Check connections to the compass, wind instrument and navigator.
	Note: *The autopilot stops adjusting the heading as soon as it loses data.*

NO PILOT	The controller is not receiving data from the SmartPilot computer. Check connections and check course computer is switched on.

81269_2.book Page 30 Wednesday, August 9, 2006 3:29 PM

ALARM MESSAGE	POSSIBLE CAUSE and SOLUTION
RG FAIL	GyroPlus yaw sensor has failed: • If you have a S1G, S2G or S3G course computer with internal GyroPlus sensor – call a Raymarine service agent. • If you have a Non-G^{5}course computer with external GyroPlus yaw sensor – check the sensor and connections, then call a Raymarine service agent.
SEATALK and FAIL 1 or 2	SeaTalk data problem on one of the SeaTalk lines – check connections.
SEATALK and FAIL	The control unit cannot transmit data to the SeaTalk system. Make sure all SeaTalk cables are connected properly.

3.2 General maintenance

Routine checks

CAUTION: Do not dismantle SmartPilot products

The SmartPilot computer and controller should be serviced only by authorized Raymarine service technicians. These products do not contain any user serviceable parts.

The SmartPilot computer does NOT contain user-serviceable parts. If you remove the main cover you will invalidate the warranty. The controller is also a sealed unit, so user maintenance is limited to the following checks

- make sure all cable connectors are firmly attached
- examine for signs of wear or damage – replace any damaged cables

Note: *Do not use chemical or abrasive materials to clean the SmartPilot computer. If the case is dirty, wipe it with a clean, damp cloth.*

Cleaning the display

CAUTION: Avoid damage when cleaning

Take care when cleaning the display. Avoid wiping the display screen with a dry cloth as this could scratch the screen coating. If necessary, use only a mild detergent.

- Never use chemical or abrasive materials to clean the controller. If it is dirty, wipe it with a clean, damp cloth.
- In certain conditions, condensation may appear inside the display screen. This will not harm the unit, and you can clear it by switching on the illumination for a short time.

81269_2.book Page 31 Wednesday, August 9, 2006 3:29 PM

EMC advice

- When powered up, all electrical equipment produces electromagnetic fields. These can cause adjacent pieces of electrical equipment to interact with one another, with a consequent adverse effect on operation.
- To minimize these effects and enable you to get the best possible performance from your Raymarine equipment, guidelines are given in the installation instructions, to enable you to ensure minimum interaction between different items of equipment, i.e. ensure optimum Electromagnetic Compatibility (EMC).
- Always report any EMC-related problems to your nearest Raymarine dealer. We use such information to improve our quality standards.
- In some installations, it may not be possible to prevent the equipment from being affected by external influences. In general this will not damage the equipment but it can lead to spurious resetting action, or momentarily may result in faulty operation.

Product support

Raymarine provides a comprehensive customer support service, on the world wide web and by telephone help line. Please use either of these facilities if you are unable to rectify a problem.

World wide web

Please visit the Customer Support area of our web site at:

www.raymarine.com

As well as providing a comprehensive Frequently Asked Questions section and servicing information, the web site gives e-mail access to the Raymarine Technical Support Department and a details of the locations of Raymarine agents, worldwide.

Telephone help line

If you do not have access to the world wide web, please call our help line.

In the USA, call:

- +1 800 539 5539, extension 2444 or
- +1 603 881 5200 extension 2444

In the UK, Europe the Middle East or the Far East, call:

- +44 (0) 23 9271 4713 (voice)
- +44 (0) 23 9266 1228 (fax)

81269_2.book Page 32 Wednesday, August 9, 2006 3:29 PM

Help us to help you

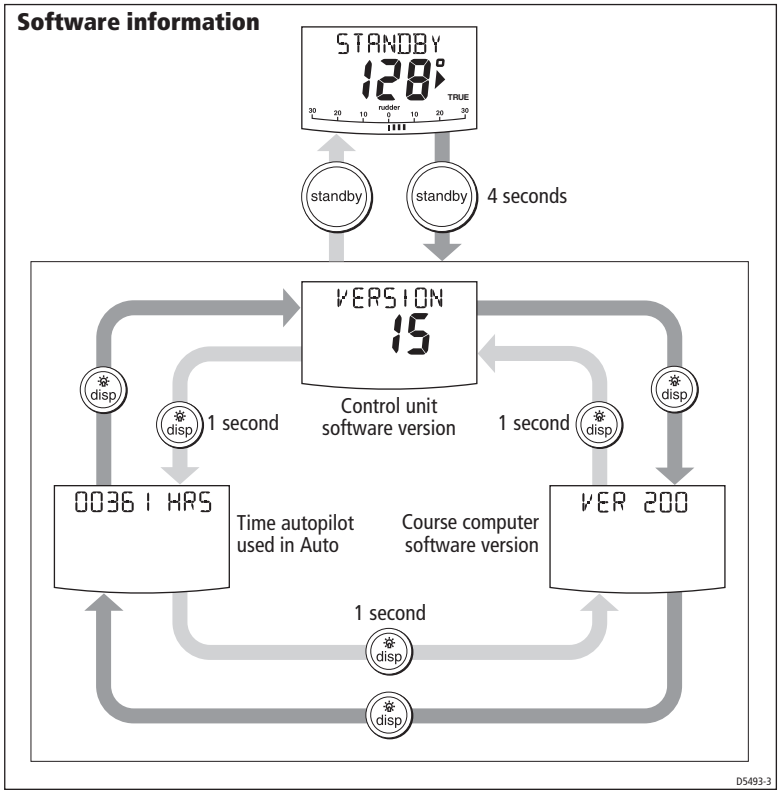
When requesting service, please quote the following product information:

- Equipment type.
- Model number.
- Serial number.
- Software issue number.

The following illustration shows how to display the software information:

- press and hold **standby** for 4 seconds:
  - after 2 seconds you will see the DISPLAY CAL screen
  - then after another 2 seconds you see controller software version
- press **disp** to display the computer software version
- press **disp** again to display the total number of hours the SmartPilot has been used in Auto mode.

Software information



81269_2.book Page 33 Wednesday, August 9, 2006 3:29 PM

Product details table

For future reference, you may want to use this table to record serial and software information for your SmartPilot:

	Serial Number	Software Version
SmartPilot Controller		
SmartPilot Computer		
Hours Used		**hours**

81269_2.book Page 34 Wednesday, August 9, 2006 3:29 PM

81269_2.book Page 35 Wednesday, August 9, 2006 3:29 PM

Specifications

ST6002 control unit

Nominal supply voltage:	12 V DC via SeaTalk
Operating voltage range:	10 V to 15 V DC
Current consumption (in Standby mode)	60 mA (less than 200 mA with full lighting)
Operating temperature:	0 °C to +70 °C (32 °F to 158 °F)
Water protection:	waterproof to CFR46
Overall dimensions: width height depth	 110 mm (4.33 in) 115 mm (4.53 in) 41 mm (1.62 in)
Keypad:	8 button illuminated keypad
Liquid Crystal Display (LCD):	shows heading, locked course and navigational data, and up to 7 data pages
LCD illumination:	3 brightness levels + off
Input connections:	SeaTalk (x2) and NMEA 0183
Output connections:	SeaTalk (x2)
CE approvals:	conforms to: 89/336/EC (EMC), EN60945:1997

SmartPilot computer functions

SmartPilot computer	
S1G, S2G and S3G systems	**Non-G systems**
• Internal GyroPlus yaw sensor • Enhanced course keeping using AST • FastTrim • Full access to AutoLearn, providing automatic steering calibration • Improved track-keeping • Steers to true and apparent wind in Wind Vane mode • Improved calibration access	• Full basic functionality • Improved track-keeping • Steers to true and apparent wind in Wind Vane mode • Improved calibration access, but without AutoLearn • Uses Raymarine steering algorithm without AST • No FastTrim

81269_2.book Page 36 Wednesday, August 9, 2006 3:29 PM

Glossary

Term	Meaning
AST	Advanced Steering Technology (AST) is Raymarine's unique advanced steering algorithm. It uses inputs from a wide variety of sensors to tune the autopilot's operation to provide superior control of the boat in any condition.
AutoLearn	Self-learning calibration feature available on S1G, S2G and S3G autopilot systems.
AutoTrim	The AutoTrim setting determines the rate at which the autopilot applies 'standing helm' to correct for trim changes caused by varying wind loads on the sails or superstructure.
AWG	American Wire Gauge.
CE	Marked on Raymarine products that comply with defined European Community standards.
counter rudder	Counter rudder is the amount of rudder the autopilot applies to try to prevent the boat from yawing off course. Higher counter rudder settings result in more rudder being applied.
CR pump	Constant Running hydraulic pump.
DC	Direct current.
EMC (Electromagnetic Compatibility)	When powered up, all electrical equipment produces electromagnetic fields. These can cause adjacent pieces of electrical equipment to interact with one another, and this can degrade their performance. By following the EMC guidelines in this handbook, you can minimize these effects by ensuring optimum Electromagnetic Compatibility (EMC) between equipment.
Fluxgate	Standard Raymarine compass supplied with course computer core pack.
GPS	Global Positioning System.
GyroPlus	Raymarine's GyroPlus yaw sensor that measures the boat's rate of turn. It is built into the S1G, S2G and S3G course computers.
I/O drive	Inboard/Outboard or stern drive.
MOB	Man overboard.
nm	Nautical mile.

81269_2.book Page 37 Wednesday, August 9, 2006 3:29 PM

Term	Meaning
NMEA	The NMEA (National Maritime Electronics Association) protocol is an internationally accepted serial communication interface standard for sharing data between electronic equipment. Raymarine products can share information with non-SeaTalk equipment using the NMEA 0183 protocol.
response	The autopilot response level controls the relationship between course keeping accuracy and the amount of helm/drive activity.
rudder gain	Rudder gain is a measure of how much helm the autopilot will apply to correct course errors. The higher the setting the more rudder will be applied.
SeaTalk	SeaTalk is Raymarine's proprietary communication system. It links the products to provide a single, integrated system sharing power and data.
SeaTalk bus	This refers to the continuous SeaTalk system connecting together a series of Raymarine units.
SM	Statute (land) mile.
VHF	Very High Frequency (radio).
WindTrim	WindTrim (wind response) controls how quickly the autopilot responds to changes in the wind direction. Higher wind trim settings will result in a pilot that is more responsive to wind changes.
XTE	Cross track error.
Yaw	The boat's rate of turn (°/sec).

81269_2.book Page 38 Wednesday, August 9, 2006 3:29 PM

81269_2.book Page 39 Wednesday, August 9, 2006 3:29 PM

Index

A

Alarms, 28
- AUTO RELEASE, 29
- CURRENT LIMIT, 29
- DRIVE STOPPED, 29
- LARGE XTE, 14
- LOW BATT, 29
- LRN FAIL, 29
- MOB, 22
- MOT POW SWAPPED, 29
- NEXT WPT, 17
- NO DATA, 29
- NO PILOT, 29
- OFF COURSE, 8
- RG FAIL, 30
- SEATALK FAIL 1 or 2, 30
- SEATALK/STLK FAIL, 30
- SHALLOW, 22
- WINDSHIFT, 20

Auto mode, 4
- AutoTack, 9
- Changing course, 5
- Dodging obstacles, 6
- Off course warning, 8

AutoRelease
- Alarm, 29

AutoTack, 9, 23
- in wind vane mode, 20

C

Contrast, 11
Controller
- Specifications, 35

Course changes, 5
Cross track error
- Explanation, 14
- LARGE XTE warning, 14

Current limit alarm, 29

D

Data pages, 21
Display
- Contrast, 11
- Illumination, 10

Dodging obstacles, 6
Drive stopped alarm, 29

F

Fault finding, 27
Following a route, 13

G

Glossary, 36—37
Gybe inhibit, 9, 23
GyroPlus fail alarm, 30

H

Help lines, 31

I

Illumination, 10

K

Keypad
- Illumination, 10

Keypad functions, 3

L

Learn fail alarm, 29
Lighting, 10
Low battery alarm, 29

M

Maintenance, 30
Man Overboard alarm, 22
Motor boats
- Power Steer, 6

Motor/Power swapped alarm, 29

N

Next WPT warning, 17
No data alarm, 29
No pilot alarm, 29

O

Off course warning
- Description, 8

81269_2.book Page 40 Wednesday, August 9, 2006 3:29 PM

P
Performance adjustment, 6
non-G systems, 7
S1G, S2G and S3G systems, 7
Power steer, 6
Preventing gybes, 9
Product support, 31

R
Response level, 24
RG fail alarm, 30
Rotary Control, 3
Route completed, 17

S
Safety notices, i
Track mode, 13
Sailboats
AutoTack, 9
Preventing gybes, 9
SeaTalk
SeaTalk fail 1 or 2, 30
SeaTalk fail alarm, 30
Service, 31
Settings
AutoTack, 23
Gybe inhibit, 23
Response level, 24
User calibration, 22
Wind type, 24
WindTrim, 24
Shallow alarm, 22
SmartPilot
Disengaging, 5
Engaging, 4
Functions, 1
Specifications, 35
Standby Mode, 5
Switching on/off, 2

T
Technical support, 31
Track mode, 13
Cross track error, 14
Dodge, 15
Next waypoint, 17
Route completed, 17
Safety, 13
Tidal compensation, 15
Waypoint names, 22

U
User Calibration, 22

W
Waypoint
Advance, 16
Advance warning, 17
Arrival, 16
Skipping, 16
Wind angle
Adjusting, 19
Wind type, 24
Wind vane mode, 18
Adjusting wind angle, 19
Apparent wind, 18
AutoTack, 20
Dodge, 19
Enabling, 18
Operating hints, 21
True wind, 18
Wind shift warning, 20
WindTrim, 18
WindTrim, 18, 24